Translation

PCT/CH2003/000551

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 02/084 WO	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/CH2003/000551	International filing date (*day/month/year*) 15 August 2003 (15.08.2003)	Priority date (*day/month/year*) 16 August 2002 (16.08.2002)
International Patent Classification (IPC) or national classification and IPC H01L 23/48, 23/051, 25/07		
Applicant ABB SCHWEIZ AG		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 08 March 2004 (08.03.2004)	Date of completion of this report 11 February 2005 (11.02.2005)
Name and mailing address of the IPEA/EP Facsimile No.	Authorized officer Telephone No.

PCT/CH2003/0005

PATENT COOPERATION TREA

SLE-I Eingang Ablage
29. APR. 2005

From the INTERNATIONAL BUREAU

PCT

SB
Visa

To:

ABB SCHWEIZ AG
Intellectual Property (CH-LC/IP)
Brown Boveri Strasse 6
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SUISSE

NOTIFICATION OF TRANSMITTAL OF COPIES OF TRANSLATION OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 72.2)

Date of mailing *(day/month/year)* 28 April 2005 (28.04.2005)	
Applicant's or agent's file reference 02/084 WO	**IMPORTANT NOTIFICATION**
International application No. PCT/CH2003/000551	International filing date *(day/month/year)* 15 August 2003 (15.08.2003)
Applicant ABB SCHWEIZ AG et al	

1. **Transmittal of the translation to the applicant.**

The International Bureau transmits herewith a copy of the English translation made by the International Bureau of the international preliminary examination report established by the International Preliminary Examining Authority.

2. **Transmittal of the copy of the translation to the elected Offices.**

The International Bureau notifies the applicant that copies of that translation have been transmitted to the following elected Offices requiring such translation:

AZ, CA, CH, CN, CO, GH, KG, KP, KR, MK, MZ, RU, TM

The following elected Offices, having waived the requirement for such a transmittal at this time, will receive copies of that translation from the International Bureau only upon their request:

AE, AG, AL, AM, AP, AT, AU, BA, BB, BG, BR, BY, BZ, CR, CU, CZ, DE, DK, DM, DZ, EA, EC, EE, EP, ES, FI, GB, GD, GE, GM, HR, HU, ID, IL, IN, IS, JP, KE, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PG, PH, PL, PT, RO, SC, SD, SE, SG, SK, SL, SY, TJ, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

3. **Reminder regarding translation into (one of) the official language(s) of the elected Office(s).**

The applicant is reminded that, where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report.

It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned (Rule 74.1). See Volume II of the PCT Applicant's Guide for further details.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Yolaine Cussac
Facsimile No.+41 22 740 14 35	Facsimile No.+41 22 338 70 80

Form PCT/IB/338 (July 1996)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/CH2003/000551

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:

pages 1-9, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☒ the claims:

pages _____, as originally filed
pages _____, as amended (together with any statement under Article 19
pages _____, filed with the demand
pages 1-6, filed with the letter of 06 January 2005 (06.01.2005)

☒ the drawings:

pages 1/1, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

☐ the sequence listing part of the description:

pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/fig _____

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* *Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).*

** *Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

Claims 1 and 6, which were submitted on 6 January 2005, go beyond the application as originally filed. The application discloses only the following:

1. Page 4, lines 22-29, and page 5, lines 25-26: The protective layer can consist of a base layer and a surface layer. However, it is not disclosed that the base and surface layers consist of different materials.

2. Page 6, lines 27-33 and page 7, lines 17-22: The surface layer consists of Ag, Au, Pd, Rh or Ru, TiN, CrN, ZrN or graphite. However, it is not disclosed that said surface layer has been applied to a base layer consisting of a different material.

3. Page 7, lines 9-11: The base layer consists of Ni. However, a surface layer consisting of a layer substantially different to that of a base layer is not disclosed.

4. Page 7, lines 14-16: The base layer prevents contact corrosion between the contact plate and the surface layer. However, it is not disclosed that the surface layer and base layer consist of substantially different materials.

5. Page 7, lines 32-34: A thin layer of gold is provided between a base layer of Ni and the surface layer in order to improve adhesion between Ni and Ru. This is the only disclosure of a concrete multi-layer (Ni/Au/Ru)

I. **Basis of the report**

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

protective film consisting of different materials. However, claim 1 is an inadmissible generalization of this Ni/Au/Ru combination.

6. Therefore, the feature in the version of claim 1 from 6 January 2005 that "... the base layer and the surface layer consist substantially of different materials" contravenes the criteria of PCT Rule 70.2(c) with respect to the original description.

7. Contrary to the criteria of PCT Rule 70.2(c), the version of claim 6 from 6 January 2005 is an inadmissible generalization of the specific materials disclosed in the original description.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	2, 4	YES
	Claims	1, 3, 5	NO
Inventive step (IS)	Claims	2, 4	YES
	Claims	1, 3, 5	NO
Industrial applicability (IA)	Claims	1-5	YES
	Claims		NO

2. Citations and explanations

1. Reference is made to the following documents:

D1: EP0932201
D2: US5008735
D3: US3280383

2. Novelty - Claim 1

Document D1 (column 10, line 31 to column 11, line 54; column 22, lines 36-50; claims 2 and 9; figures 7, 8 and 18) discloses a power semiconductor module comprising

- at least one semiconductor chip (11) consisting of a semiconductor material and with a first and a second main electrode,
- a first and a second main connector,
- a contact plate (13) in electric contact with the first main electrode and the first main connector,
- said contact plate (13) containing an alloy partner (Ag, Al) and it being possible to form a eutectic between the alloy partner and the semiconductor material,
- said contact plate (13) being coated with an electrically conductive protective layer (15) of a precious metal (Au). Since the formulation according

to claim 1 does not exclude the possibility that the protective layer consists of a precious metal, the contact surface would also necessarily consist of a precious metal. Therefore, claim 1 does not appear to satisfy the requirements of PCT Article 33(2) with respect to document D1.

Furthermore, the protective layer 15 in D1 is produced by "plating", which usually involves a base layer ("seed") and a main layer, i.e. a two-layer design.

3. Dependent claims 3 and 5 do not contain any features that, in combination with the features of any claim to which they refer back, meet the PCT requirements for novelty and inventive step. The reasons are as follows:

Claim 3 relates to layer thicknesses that are normal for power semiconductors (see e.g. D1, column 10, line 58 to column 11, line 5). Therefore, claim 3 does not appear to satisfy the requirements of PCT Article 33(2).

Document D1 (column 10, line 31 to column 11, line 54; figures 7 and 8), which also contains all of the features of claim 1, discloses moreover that the semiconductor is an IGBT. Therefore, claim 5 does not appear to satisfy the requirements of PCT Article 33(2).

PATENT CLAIMS (amended on Jan.06 2005)

1. A power semiconductor module comprising
- at least one semiconductor chip (11) made of a semiconductor material and having a first and a second main electrode,
- a first and second main connection (91, 92),
- a contact lamina (2) in electrical contact with the first main electrode and the first main connection (92),
- the contact lamina (2) containing an alloying partner and it being possible for a eutectic to be formed between the alloying partner and the semiconductor material,
- the contact lamina being coated with an electrically conductive protective layer (31, 32),

[~~an external contact area of the protective layer (31, 32) substantially comprising a noble metal, an electrically conductive nitride or a graphite,~~]

characterized in that
- the protective layer (31, 32) has at least one electrically conductive base layer (31) applied on the contact lamina (2), and
- an electrically conductive surface layer (32), which forms the external contact area,

and in that
- the base layer and the surface layer substantially comprise different materials.

2. The power semiconductor module as claimed in claim 1, characterized in that
- the base layer (31) substantially comprises Ni and preferably has a thickness of between approximately 1 µm and 15 µm, preferably between 2 µm and 8 µm.

3. The power semiconductor module as claimed in claim 1 or 2, characterized in that
- the surface layer (32) has a thickness of between approximately 0.1 µm and 5 µm.

4. The power semiconductor module as claimed in one of claims 1 to 3, characterized in that

- the surface layer (32) substantially comprises Ru,
- an electrically conductive intermediate layer is provided between the surface layer (32) and the base layer (31), said intermediate layer substantially comprising Au and preferably having a thickness of approximately 0.2 µm, and
- the base layer (31) preferably has a thickness of between 5 µm and 12 µm.

5. The power semiconductor module as claimed in one of the preceding claims, characterized in that

- the semiconductor chip (11) internally has an IGBT structure or a diode structure.

6. The power semiconductor module as claimed in claim 1, characterized in that

- the base layer (31) comprises a good covering material, and in that
- the surface layer (32) comprises a material having one or more of the following properties:
  - a non-oxidizable, preferably exhibiting little chemical reactivity,
  - b does not react chemically with a first electrode metallization of the first main electrode and exhibits neither contact corrosion nor material diffusion,
  - c has a low coefficient of friction,
  - d can be deposited at temperatures at which the contact layer is not damaged or deformed.